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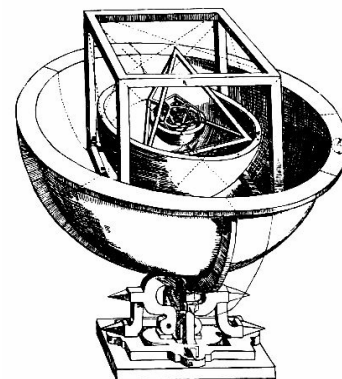
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Harmony of the Spheres: *(The Geometry of Music)*

It is now realised that acoustics have played an important part in our lives for several tens of thousands of years. Palaeolithic caves have been shown to share a relationship between the location of their internal cave art and areas which demonstrate high acoustic qualities. (2) We also know that acoustic qualities were deliberately built into prehistoric constructions around the world.

[\(More about Acoustics in Prehistory\)](#)

Although there is little recognition for the relationship between music, mathematics and physical universe, it seems that such a knowledge has been understood for thousands of years having been incorporated into myths and even the dimensions of certain sacred places in order to enhance them. The harmonic qualities of music can have a profound and beneficial effect on the human psyche (4), something that was perhaps realised more than it is today.



The Geometry of Music:

It is a simple fact that music is based on mathematics. Put simply, each note has its own vibration, and it is the frequency of the vibrations that distinguishes one note from another. The notes on each scale are separated from one another by simple mathematical proportions and our ear is able to recognise that.

1:2, 2:3, 3:4, 8:5 etc.

What that means is that when a wrong note is played in a symphony, even the untrained ear can recognise that there is something wrong, sounds that conform to these ratios are '*pleasing*' to the ear, whilst those that don't are '*dischordal*'. It seems that our brains are programmed to understand the mathematical relationships between notes and harmonies.

The first confirmed discovery of a musical instrument we have comes from around 35,000 years ago (3), with several flutes having been found made from mammoth and bird bones. Earlier discoveries have been claimed from the Neanderthal from 40 - 60,000 years ago, but these are speculative at present. Significantly these early instruments have been shown to use the same diatonic scales (based on the same seven notes that we use today). The same diatonic scales are also found in early Sumeria, China and Europe, (5) suggesting an extremely early origin for the preference for mathematical harmony.

[\(More about Bone Flutes\)](#)



Rhythmic repetitive music is a well-known method for humans into the trance, or altered state of consciousness (for example, during shamanistic rituals).

(Image Credits: <http://news.bbc.co.uk/1/hi/8117915.stm>)

The **RigVeda** from Indian prehistory (*Veda* meaning 'knowledge' or 'wisdom' in Sanskrit), is believed to be a mathematical metaphor for a cosmological knowledge base, derived from a musical model. (6) The Vedas are believed to be the oldest texts in the Indian subcontinent, handed down by oral tradition alone until c. 100 BC. (7) The metaphors of the Vedas are simultaneously descriptive of astronomy, mathematics, music, poetry and art. They describe a dynamic and cyclic universe with the harmonic musical ratios operating as a physical, figurative and literal medium between ourselves and the authors.

[\(More about Prehistoric India\)](#)

Cuneiform sources from ancient **Sumeria** reveal an orderly organized system of diatonic scales. (8) How closely connected this was to their astronomical and mathematical researches is unknown, but we know that the Sumerian and Vedic cultures were closely connected through the discoveries of similar clay 'seals' found in both locations and that they shared a similar understanding of the movements of the heavens. The

immense regard with which later Mesopotamian sciences showed to astronomy is reflected in the extraordinarily large number of astronomical records discovered in ruined libraries such as Nineveh, Nippur and Ur. Apparently the Chaldeans were the first people to conceive of the heavenly bodies joining in a cosmic chant as they moved in stately manner across the sky. Job describes a time "when the stars of the morning sang together," (11)

[\(More about Sumeria\)](#)

In **Chartres Cathedral**, and many other medieval buildings, these harmonic ratios were translated into the architecture of the magnificent structures. It appears that not only do these ratios define the sounds we find pleasing but also the physical proportions of beauty. The architecture of Chartres Cathedral has been described as 'frozen music' on account of the large number of musical proportions embodied into the design. It became one of the most important French pilgrimage sites, and was built at the same time (11th - 13th centuries) as several other immense gothic cathedrals in Europe, incorporating sacred geometry and harmonic proportions in their quest to bring mankind closer to god.

[\(The Chartres Labyrinth\)](#)

The Harmony of the Spheres:

The first confirmed record of a knowledge of the relationship between astronomy, music and geometry comes (almost predictably) from the Greeks; In particular, Pythagoras who wrote of the 'Harmony of the Spheres', and of whom it was said: '*...of all men, he alone [Pythagoras] could hear the music of the spheres...*'.

Pythagoras - As well as being a profound philosopher and mathematician, Pythagoras is accredited for discovering the simple fact that the pitch of a musical note depends upon the length of the string which produces it. This allowed him to correlate the intervals of the musical scale with simple numerical ratios. His discoveries in the fields of music and astronomy led him to his most profound realisation, namely, '*The Harmony of the Spheres*', wherein he proposed that the planets and stars moved according to mathematical equations, which corresponded to musical ratios, therefore producing a symphony. (9)

"Because the Pythagoreans thought that the heavenly bodies were separated from one another by intervals corresponding to the harmonic lengths of strings, they held that the movement of the spheres gives rise to a musical sound called the "harmony of the spheres."

(Ref: Microsoft Encarta Encyclopaedia 2000)

The names given by the Pythagoreans to the various notes of the diatonic scale were, according to Macrobius, derived from an estimation of the velocity and magnitude of the planetary bodies. Each of these gigantic spheres as it rushed through space was believed to sound a certain tone caused by its continuous displacement of the æthereal diffusion. As these tones were a manifestation of divine order and motion, it must necessarily follow that they partook of the harmony of their own source. "The assertion that the planets in their revolutions round the earth uttered certain sounds differing according to their respective 'magnitude, celerity and local distance,' was commonly made by the Greeks. Thus Saturn, the farthest planet, was said to give the gravest note, while the Moon, which is the nearest, gave the sharpest. 'These sounds of the seven planets, and the sphere of the fixed stars, together with that above us [Antichthon], are the nine Muses, and their joint symphony is called Mnemosyne.'" (11)

Quote from Aristotle: ... "[the Pythagoreans] saw that the ... ratios of musical scales were expressible in numbers [and that] .. all things seemed to be modelled on numbers, and numbers seemed to be the first things in the whole of nature, they supposed the elements of number to be the elements of all things, and the whole heaven to be a musical scale and a number:" (10)

The Pythagoreans also used music to heal the body and to elevate the soul, believing that earthly music was '*...a faint echo of the universal harmony of the spheres...*' (1)

Johannes Kepler - '*Harmonice Mundi*' (*The Harmony of the World*), published in 1619.

Kepler, who was influenced by arguments in Ptolemy's *Optics* and *Harmonica*, compiled his *Harmonices Mundi* ('Harmony of the World'), which presented his own analysis of optical perceptions, geometrical shapes, musical consonances and planetary harmonies. According to Kepler, the connection between geometry (sacred geometry), cosmology, astrology, harmonics and music is through *musica universalis*.

Kepler discovered physical harmonies in planetary motion. He found that the difference between the maximum and minimum angular speeds of a planet in its orbit approximates a harmonic proportion. For instance, the maximum angular speed of the Earth as measured from the Sun varies by a semitone (a ratio of 16:15), from *mi* to *fa*, between aphelion and perihelion. Venus only varies by a tiny 25:24 interval (called a diesis in musical terms).

Kepler also discovers that all but one of the ratios of the maximum and minimum speeds of planets on neighbouring orbits approximate musical harmonies within a margin of error of less than a diesis (a 25:24 interval). The orbits of Mars and Jupiter produce the one exception to this rule, creating the un-harmonic ratio of 18:19. (12) In fact, the cause of Kepler's dissonance might be explained by the fact that the asteroid belt separates those two planetary orbits, as discovered in 1801, 150 years after Kepler's death. (13)

It is perhaps interesting to note that all the platonic solids also realised by Kepler are represented in the several hundred small, carved Scottish prehistoric petrospheres.

[\(More on the Stone Balls of Scotland\)](#)

Recent Articles on the 'Harmony of the Spheres'.

Article: *The Telegraph*, (Aug. 2011):

'The works of Plato, the ancient classical Greek philosopher, appear to contain a hidden musical code, a British academic has claimed':

Dr Jay Kennedy, an historian and philosopher of science at the University of Manchester, found Plato used a regular pattern of symbols to give his writing a "musical" structure. In his five year study, Dr Kennedy found Plato, who died around 347BC, used the symbols inherited from the ancient followers of Pythagoras. His findings, published in the American classics journal *Apeiron*, suggested Plato was not only a secret follower of Pythagoras but also shared his belief that the universe's secrets lay maths and its numbers. Dr Kennedy said the key to unlocking the code came from the 12 notes of the Greek musical scale, which he said was popular among followers of Pythagoras. Using computer technology, he restored contemporary versions of Plato's manuscripts to their original form, which he said consisted of lines of 35 characters, with no spaces or punctuation. Dr Kennedy discovered that some key phrases, themes and words occurred during regular intervals throughout, which matched the spacing in the 12 note scale. He argued that Plato did not use the code for pleasure, but instead for his own safety after his teacher was executed for heresy.

(Link to Full Article: <http://www.telegraph.co.uk>)

Article: 'Distant stars make music'. <http://news.bbc.co.uk/1/hi/sci/tech/1994038.stm>

Article: 'Music of the stars' now louder. <http://www.bbc.co.uk/news/science-environment-12507032>

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Further Research:

- Sonic Geometry: Youtube Video on the Connection between Music and Geometry: [The Language of Frequency and Form](#)

